

Cotaco Creek Embayment Wheeler Reservoir Intensive Basin Survey 2015

WHEL-4: Cotaco Creek immediately upstream of Sharps Ford Bridge (Morgan Co 34.54297/-86.72628)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) began monitoring lake water quality statewide in 1985, followed by a second statewide survey in 1989. In 1990, the Reservoir Water Quality Monitoring Program [now known as the Rivers and Reservoirs Monitoring Program (RRMP)] was initiated by ADEM.

The current objectives of this program are to provide data that can be used to assess current water quality conditions, identify trends in water quality conditions and to develop Total Maximum Daily Loads (TMDLs) and water quality criteria. Descriptions of all RRMP monitoring activities are available in ADEM’s 2012 Monitoring Strategy (ADEM 2012).

In 2015, ADEM monitored the Cotaco Creek tributary embayment of Wheeler Reservoir as part of the basin assessment of the Tennessee River under the RRMP. This site was selected using historical data and previous assessments. The purpose of this report is to summarize data collected in the Cotaco Creek embayment (WHEL-4) during the 2015 growing season (Apr-Oct). This is the fourth basin assessment of the Tennessee River since ADEM began sampling. Monthly and/or mean concentrations of nutrients [total nitrogen (TN); total phosphorus (TP)], algal biomass/productivity [chlorophyll *a* (chl *a*); algal growth potential testing (AGPT)], sediment [total suspended solids (TSS)], and trophic state [Carlson’s trophic state index (TSI)] from 2015 were compared to ADEM’s historical data and established criteria.



Figure 1. Photo of Cotaco Creek at WHEL-4.

WATERSHED CHARACTERISTICS

Watershed land uses are summarized in Table 1. Cotaco Creek is classified as a *Swimming/Fish & Wildlife (S/F&W)* stream located in the Eastern Highland Rim ecoregion (71g). Based on the 2011 National Land Cover Dataset, land use within the 238 mi² watershed is a mix of hay/pasture (33%) and forest (45%) (Fig. 3). As of January 28, 2016, ADEM has issued a total of 33 NPDES permits within the watershed. Four of those permits are located within 10 mi of the station (Fig. 2).

SITE DESCRIPTION

The Cotaco Creek embayment at WHEL-4 is located southwest of Huntsville, AL near Valhermoso Springs, AL. It is a riverine embayment that flows into the Tennessee River near river mile 319. Cotaco Creek has a mean bottom depth of 4.40 m (Table 2) at the sampling location.

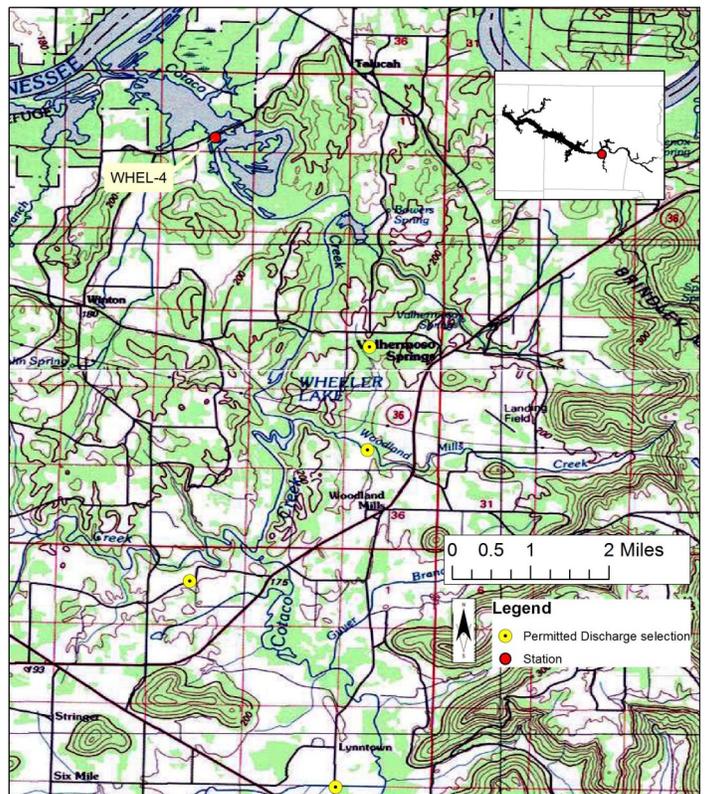


Figure 2. Map of Cotaco Creek embayment of Wheeler Reservoir. Though additional permitted facilities may occur in the watershed (Table 1), only those within 10 miles upstream of the station are displayed on the map.

METHODS

Water quality assessments were conducted at monthly intervals, April-October. All samples were collected, preserved, stored, and transported according to procedures in the ADEM Field Operations Division Standard Operating Procedures (ADEM 2015), Surface Water Quality Assurance Project Plan (ADEM 2012), and Quality Management Plan (ADEM 2013).

Mean growing season TN, TP, chl *a*, and TSS were calculated to evaluate water quality conditions. Monthly concentrations of these parameters were graphed with ADEM's previously collected data to help interpret the 2015 results. Carlson's TSI was calculated from the corrected chl *a* concentrations.

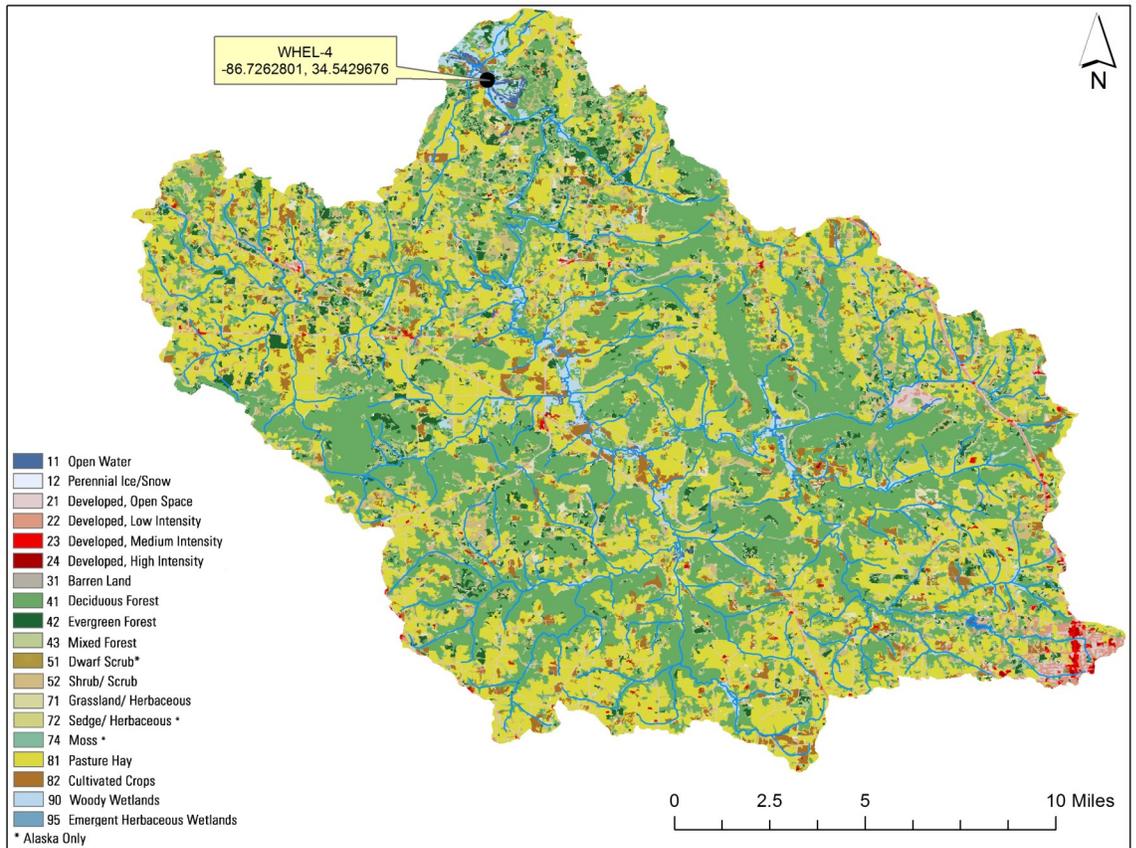


Figure 3. Land use within the Cotaco Creek watershed at WHEL-4.

RESULTS

Table 1: Summary of Watershed WHEL-4

Basin	Tennessee R
Drainage Area (mi ²)	238
Ecoregion ^a	71g
% Land use	
Open Water	1%
Developed	Open Space 4%
	Low Intensity 1%
	Medium Intensity <1%
	High Intensity <1%
Barren Land	<1%
Forest	Deciduous Forest 36%
	Evergreen Forest 4%
	Mixed Forest 5%
Shrub/Scrub	7%
Herbaceous	2%
Hay/Pasture	33%
Cultivated Crops	4%
Wetlands	Woody 2%
	Emergent Herb. <1%
# NPDES outfalls ^b TOTAL	
Construction Stormwater	11
Small Mining	2
Industrial General	14
Municipal	6

a. Eastern Highland Rim

b. #NPDES outfalls downloaded from ADEM's NPDES Management System database, Jan 28, 2016.

The following discussion of results is limited to those parameters which directly affect trophic status or parameters which have established criteria. Results of all water chemistry analyses are presented in Table 2. The axis ranges of the graphs in Figs. 4-6 were set to maximum values reservoir wide so all embayment reports on the same reservoir could be compared.

The growing season mean TN value in 2015 was lower than 2013 (Fig. 4). Monthly TN concentrations were highest in September.

The mean growing season TP concentration increased slightly in 2015 from 2013 (Fig. 4). Monthly TP concentrations were highest in April.

Growing season mean chl *a* has declined 2003-2015 (Fig. 4). Monthly chl *a* concentrations were highest in July and October.

Mean TSI has remained eutrophic 2003 through 2015. Monthly TSI increased throughout the growing season from oligotrophic in April to eutrophic conditions in July, September and October (Fig. 4).

Mean growing season TSS was higher in 2015 than 2013 (Fig. 5). Monthly TSS concentrations declined April-June then increased to highest concentrations in October.

No AGPT sample was collected from Cotaco Creek in 2015. Results from 2003-2013 are shown in Table 3.

The DO concentration at the WHEL-4 station was below the ADEM criteria limit of 5.0 mg/L at 5.0 ft (1.5 m) in August (ADEM Admin. Code R. 335-6-10-.09) (Fig. 6).

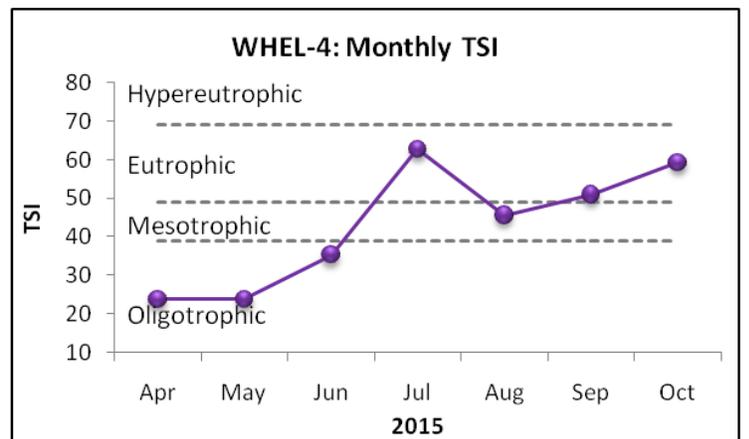
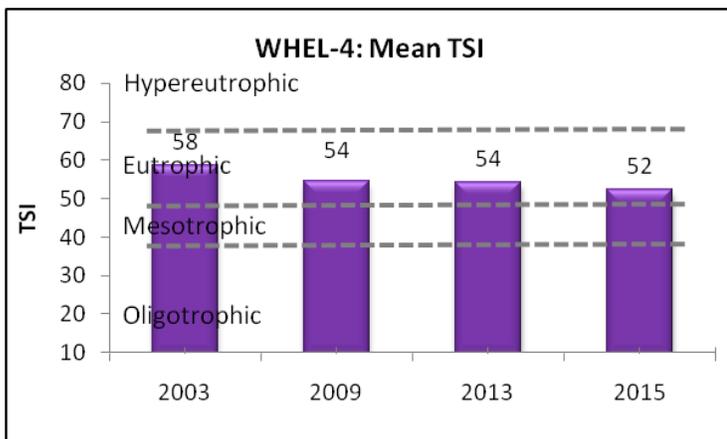
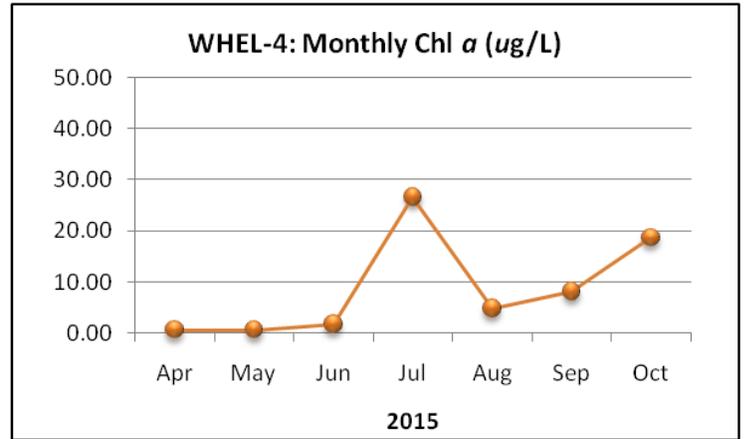
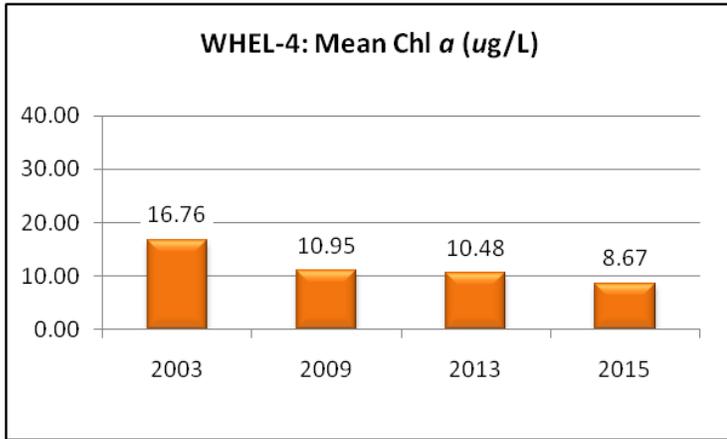
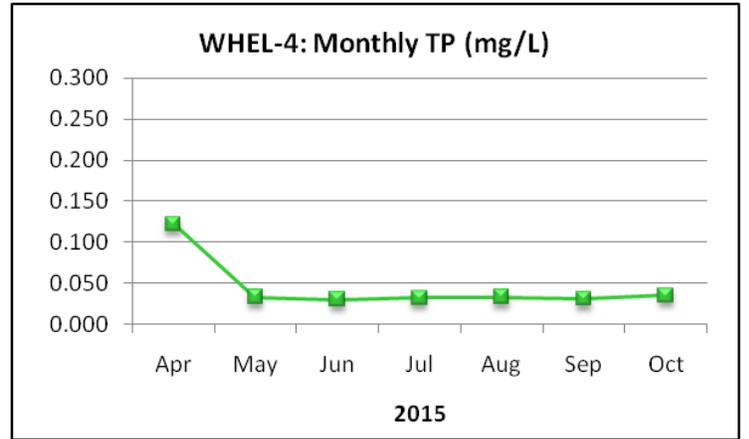
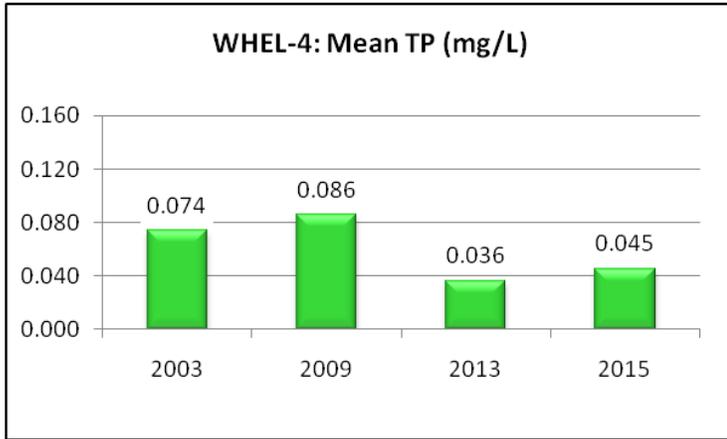
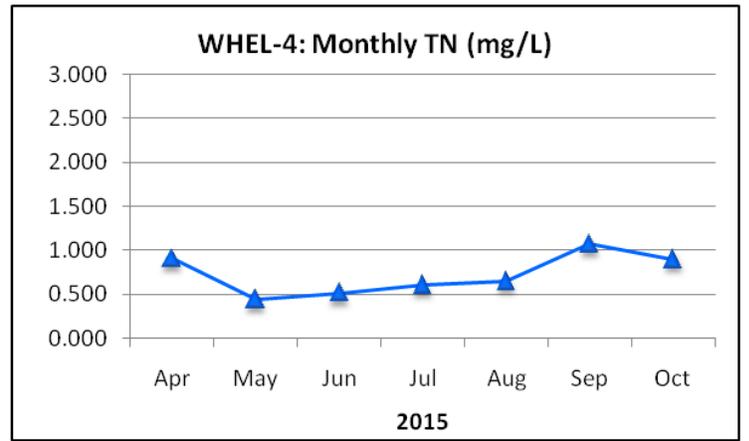
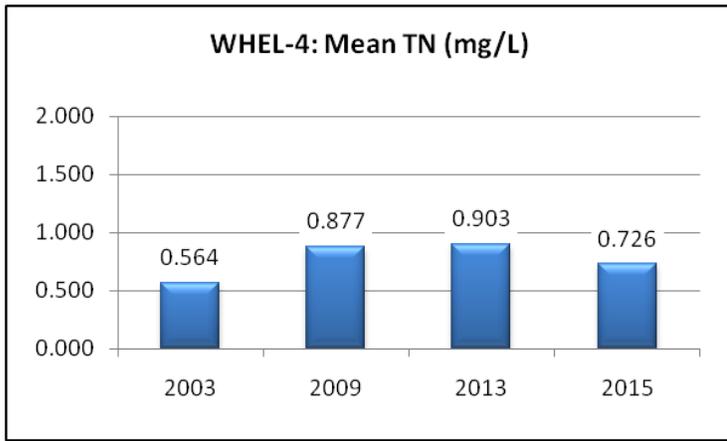


Figure 4. Mean growing season (2003-2015) and monthly (April-October, 2015) TN, TP, chl *a* and TSI measured in the Cotaco Creek embayment of Wheeler Reservoir. Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir.

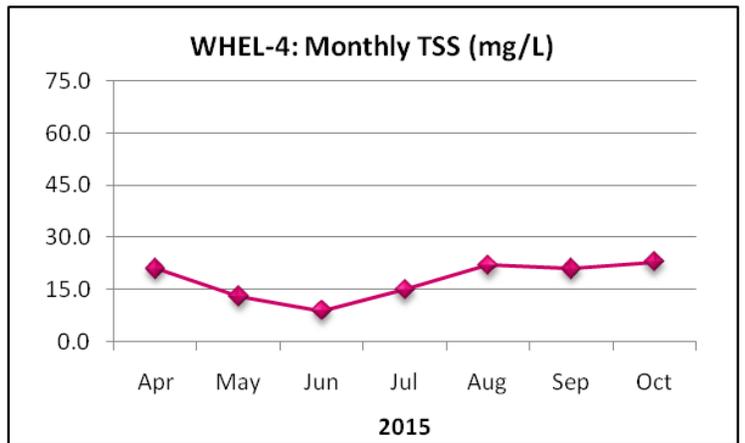
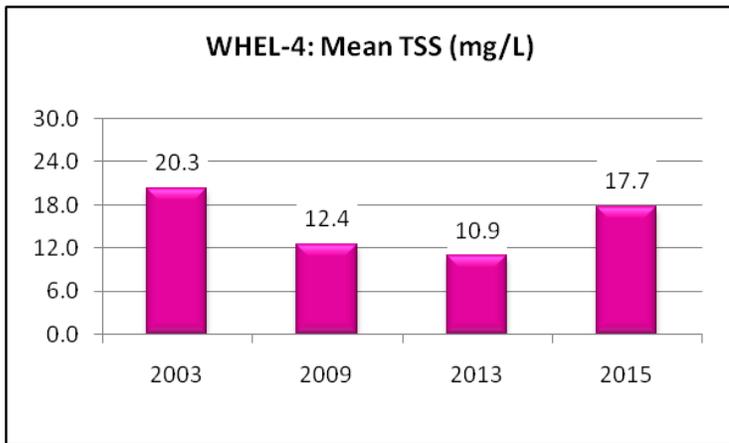


Figure 5. Mean growing season and monthly TSS measured in the Cotaco Creek embayment of Wheeler Reservoir.

Table 2. Summary of water quality data collected April-October, 2015. Minimum (Min) and maximum (Max) values calculated using minimum detection limits. Median (Med), mean, and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

WHEL-4	N	Min	Max	Med	Mean	SD
Physical						
Turbidity (NTU)	7	16.1	29.6	18.0	20.3	5.0
Total Dissolved Solids (mg/L) ^J	7	81.0	129.0	109.0	107.6	17.0
Total Suspended Solids (mg/L) ^J	7	9.0	23.0	21.0	17.7	5.4
Hardness (mg/L)	4	58.1	112.0	92.9	89.0	23.2
Alkalinity (mg/L)	7	53.5	109.9	89.8	87.2	16.8
Photic Zone (m)	7	1.37	2.02	1.70	1.66	0.22
Secchi (m)	7	0.41	0.80	0.63	0.62	0.13
Bottom Depth (m)	7	4.00	4.61	4.40	4.40	0.23
Chemical						
Ammonia Nitrogen (mg/L) ^J	7	< 0.007	0.031	0.015	0.015	0.011
Nitrate+Nitrite Nitrogen (mg/L) ^J	7	< 0.001	0.416	0.105	0.119	0.144
Total Kjeldahl Nitrogen (mg/L)	7	0.288	1.070	0.488	0.607	0.275
Total Nitrogen (mg/L) ^J	7	< 0.439	1.070	0.647	0.726	0.233
Dissolved Reactive Phosphorus (mg/L) ^J	7	0.003	0.051	0.004	0.011	0.018
Total Phosphorus (mg/L) ^J	7	0.030	0.122	0.033	0.045	0.034
CBOD-5 (mg/L) ^J	7	< 2.0	3.1	1.0	1.3	0.8
Chlorides (mg/L)	7	1.8	5.1	4.3	3.9	1.2
Biological						
Chlorophyll a (ug/L)	7	< 1.00	26.70	4.67	8.67	10.21
E. coli (col/100mL) ^J	3	4	16	13	10	6

J= one or more of the values is an estimate; N= # samples.

Table 3. Algal growth potential test results (expressed as mean MSC) dry weights of *Selenastrum capricornutum* in mg/L) and limiting nutrient status. MSC values below 5 mg/L are considered to be protective in reservoirs and lakes (Raschke and Schultz 1987).

Year	Mean MSC	Limiting Nutrient
8/19/2003	5.01	NITROGEN
8/18/2009	3.68	NITROGEN
8/20/2013	4.12	PHOSPHOROUS

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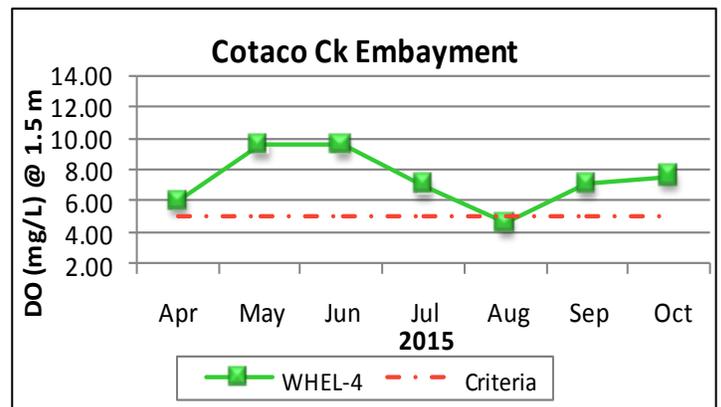


Figure 6. Monthly DO concentrations at 1.5 m (5 ft) for Cotaco Creek embayment station of Wheeler Reservoir collected April-October 2015. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth.

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